PROJECT NUMBER: 2501
PROJECT TITLE: Smoke Chemistry
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I. SIDESTREAM SMOKE

A. Objective: Conduct analyses on mainstream and sidestream smoke to determine qualitative and quantitative differences between control and reduced visibility cigarettes. Develop methods to analyze for selected components. Demonstrate effective methods for reduction or removal of these components.

B. Results: Sidestream visibility, particle size, particulate generation rate, mass burn rate and relative particulate fraction data have been obtained on the cigarette models described in the September monthly report. These cigarette models were manufactured to address the effects of circumference and Mg(OH)2 wrappers on mainstream and sidestream smoke chemistries and on sidestream visibility. GC/MS analyses of sidestream and mainstream smoke from these models is ongoing. RS/1 is being utilized to analyze component variability and run to run reproducibility. Individual sidestream component analyses are being carried out by the Analytical Research Division.

A new scheme has been investigated for analyzing sidestream smoke. The procedure consists of collecting a portion of sidestream smoke from the total smoke generated during static burn of four cigarettes onto a column of silica gel followed by elution of the silica gel with hexane and then with ethyl acetate. The eluted fractions are then gas chromatographed with detection by NPD, FID and MSD. This procedure is quick, simple and reproducible. Since multiple separation schemes are used, portions of sidestream smoke not previously observed using more direct sampling and analysis schemes are seen.

C. Conclusions: Visibility measurements indicate the expected decrease in visibility at a given circumference by replacement of conventional wrappers with Mg(OH)2 wrappers. A small, but significant, visibility reduction is evidenced with reduced circumference cigarettes at constant blend and the same wrapper. As expected, additional reduction occurs in the 17mm circumference cigarettes with low visibility wrappers.

Sidestream smoke from cigarettes with and without 35% Mg(OH)2 wrappers have been investigated by the new separation scheme. Elution with ethyl acetate gave fractions which contained numerous nitrogenous compounds, including nitriles, pyrazines, pyridines, pyrroles, etc., moderately polar unsaturated materials, many ketones but few acids or aldehydes. This fraction smelled much like cigarette smoke. A total of 125 individual components have been identified in these fractions. Some reproducible but relatively small differences can be seen between the two cigarette models. A re-run of the samples after standing for a week yielded

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additional small differences. These may correlate with a somewhat noticeable odor difference and with the obvious formation of a colored layer on the walls of the glass vials.

D. **Plans**: Continue GC/MS studies on the total mainstream and sidestream smoke from the cigarette models with different circumferences and with and without Mg(OH)2 wrappers.

Investigate the hexane fraction generated by the new separation technique and initiate efforts to analyze that portion of sidestream smoke not trapped on the silica gel column. Consider additional solvents and other materials for separation and trapping of sidestream smoke.

In conjunction with the Analytical Research Division, continue the studies to determine levels of certain components of sidestream smoke.

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